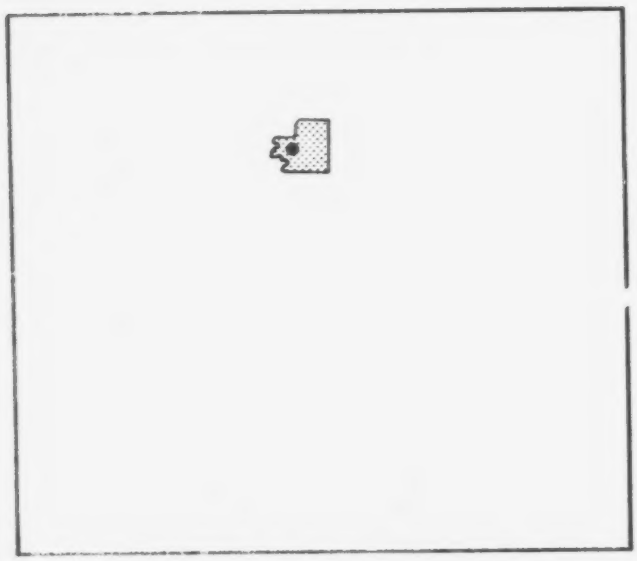
FLOOD INSURANCE STUDY

TOWN OF GEORGETOWN, COLORADO
CLEAR CREEK COUNTY



JUNE 5, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 080035

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. Please contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWN OF GEORGETOWN, CLEAR CREEK COUNTY, COLORADO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Georgetown, Clear Creek County, Colorado, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to establish actuarial flood insurance rates and assist in the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study was prepared by compiling pertinent information for the flood hazard areas in the Town of Georgetown, Clear Creek County, Colorado, from existing technical and/or scientific data originally prepared by others for purposes other than those of the NFIP. The existing data were reviewed by the Federal Emergency Management Agency (FEMA) prior to its use in the development of this Flood Insurance Study to ensure compliance with NFIP regulations.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgements

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by The Colorado Water Conservation Board (CWCB) and completed in February 1987 (Reference 1).

1.3 Coordination

On May 24, 1988, the results of this study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Georgetown, Clear Creek County, Colorado. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data.

Clear Creek was studied from the downstream corporate limits, approximately 760 feet downstream of the 22nd Street Bridge, upstream to a point approximately 1,650 feet upstream of the 6th Street Bridge, a reach of approximately 1.8 miles.

South Clear Creek was studied from a point approximately 255 feet downstream of the Rose Street Bridge upstream to a point approximately 1,400 feet upstream of the Main Street Bridge, a reach of approximately 0.8 mile.

2.2 Community Description

The Town of Georgetown is located in Clear Creek County, Colorado. Georgetown is approximately 2 miles east of the Town of Silver Plume, 3 miles south of the Town of Empire, 11 miles west of the City of Idaho Springs, and 45 miles west of the City and County of Denver, Colorado. Georgetown is approximately 2 square miles in area.

Georgetown was established during the mid-1800s gold rush. By 1877, Georgetown's population reached its peak as it neared 5,000. With the wane of the gold rush, silver became the major industry. Around the turn of the century this industry also waned, and by the 1930s the population had dwindled to a mere 200. Today, the town is thriving with a population of 922 (based on distribution of State Lottery funds for 1987) and a revenue based mainly on tourism.

Clear Creek and South Clear Creek (also known locally as Leavenworth Creek) both flow through Georgetown in narrow channels with fairly steep slopes. The headwaters of Clear Creek are located near the Continental Divide with the highest point in the basin of Grays Peak at 14,270 feet National Geodetic Vertical Datum (NGVD). Clear Creek at Georgetown Lake (at the downstream end of Georgetown) has a water-surface elevation of approximately 8,445 feet NGVD. The creek flows easterly for most of its length until it reaches Georgetown, where it flows northerly.

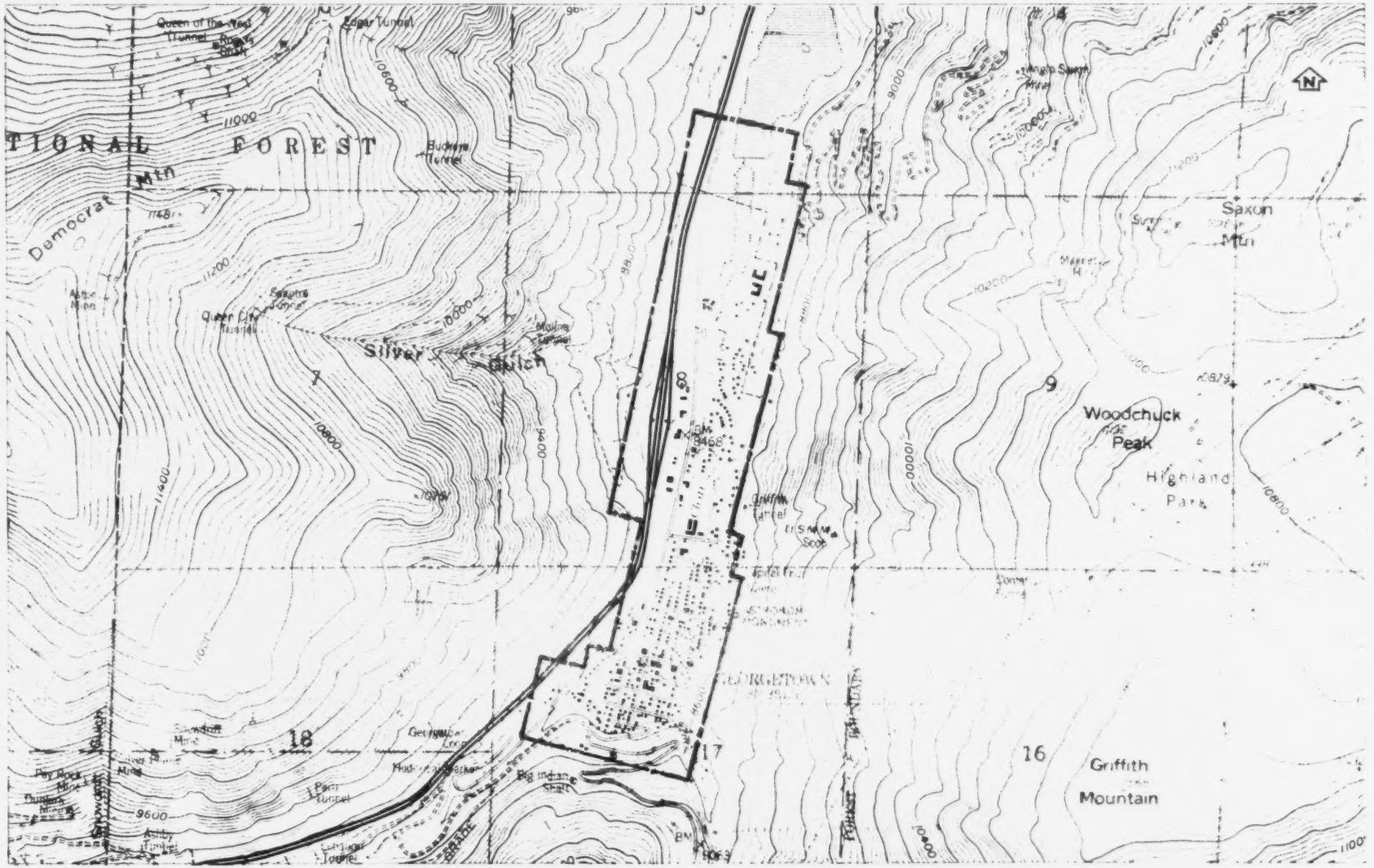


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEARCREEK COUNTY)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

The headwaters of South Clear Creek basin are located near the Continental Divide with the highest point in the basin at 13,850 feet NGVD (Mount Edwards). South Clear Creek flows northerly from its headwaters to its confluence with Clear Creek within the Georgetown corporate limits. South Clear Creek has one major tributary, Leavenworth Creek, which meets South Clear Creek approximately one mile upstream from Georgetown's upstream corporate limit.

The temperature in Georgetown varies considerably, with an average monthly low of -26°F in January and an average monthly high of 92°F during June and July. Winters are long and cold with mean daily temperatures near 30°F from November to March. The normal average precipitation in the area is approximately 16 inches (Reference 2).

2.3 Principal Flood Problems

Major flooding has occurred throughout the area studied by detailed methods in Georgetown. A flood occurred along Clear Creek at Rose and 10th Streets on June 9, 1864. A levee was constructed the following day to keep the stream within its limit (Reference 3). This levee is no longer in existence. Another flood occurred following three days of heavy rainfall ending on July 23, 1965, when water spilled out of its bank at three locations along South Clear Creek and an area from Main to Rose and 8th and 11th Streets was inundated (Reference 3). A snowmelt flood occurred along Clear and South Clear Creeks in June 1983.

Flooding in Georgetown is primarily caused by either spring snowmelt or snowmelt in conjunction with rainfall. An exception to the usual pattern of flooding occurred on July 23, 1965. Heavy hailstorms occasionally cause drifts of hail that block drainage paths and create some flooding, which occurred on the aforementioned date.

2.4 Flood Protection Measures

There are no existing flood control structures in the study area which could reduce the present flood hazard.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, and 500-year floods, have a 10-, 2-,

1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Hydrology for Clear Creek and South Clear Creek was obtained through methods described in the Manual for Estimating Flood Characteristics of Natural-Flow Streams In Colorado (Reference 4). There are no flood control reservoirs upstream from the town on either creek, nor any detention reservoirs.

Hydrology for Clear Creek at the northern corporate limit of Georgetown (downstream from its confluence with South Clear Creek) was derived through a statistical analysis of annual peak flows at USGS gage 06716500, Clear Creek near Lawson (period of record: March 1946 to present). This information was then transferred to the subject location using a weighting of the computed flood peaks at the gage with flood peaks calculated with regional regression equations (Mountain Region equations). Drainage area ratios are also employed in this method. Data used in establishing peak flows were as follows: 38 years of annual peak flows from the Lawson gage data; drainage area at the gage; drainage area at Georgetown's northern corporate limit; and mean annual precipitation above the gage. A statistical analysis of 38 years of gage data using log-Pearson Type III fitting of data was conducted.

Hydrology for South Clear Creek and for Clear Creek upstream from its confluence with South Clear Creek was based on the Mountain Region regression equations. Parameters used in establishing peak flows were: drainage area of Clear Creek upstream from its confluence with South Clear Creek; mean annual precipitation upstream from this point; drainage area of South Clear Creek; and mean annual precipitation from the mouth of the creek.

Peak discharge-drainage area relationships for Clear Creek and South Clear Creek are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (cubic feet per second) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
Clear Creek At northern corporate limit of Georgetown	81.0	980	1330	1480	1810
Clear Creek Upstream from South Clear Creek	47.5	600	830	910	1110
South Clear Creek At mouth	30.7	420	580	640	790

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

An analysis of the hydraulic characteristics of Clear Creek and South Clear Creek was performed to determine water-surface elevations for the 10-year and 100-year floods on each stream. Cross section data were taken from a 2-foot contour map of the Town of Georgetown (Reference 5). Building areas were "blocked out" of the cross sections to determine the effective flow through the floodplain. This cross section data became input data for the U.S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program. Bridge elevations and sizes of openings were surveyed and measured in the field by Black and Veatch Consulting Engineers (B&V). The data were reviewed and field checked by the CWCB.

A comparison of bridge cross section elevations surveyed by B&V with those obtained from the 2-foot contour map led to the conclusion that there was a significant problem with the datum of one of the two sources. Further study of the problem was thus undertaken. Two other sources of elevation data were used in this analysis: a 1-foot contour map of the vicinity of Georgetown Lake (Reference 6), and two field surveys of selected cross sections along Clear Creek performed in May 1979 by Hayes and Soucie. A total of 60 points from the three described sources were compared with the corresponding points on the 2-foot contour map. From

this, it was determined that the 2-foot contour map had datum that was, on the average, 1.5 feet high (it was 1.5 feet higher than the mean sea level datum of 1929).

The CWCB field surveys were used to determine channel bottom elevations in the areas where there was recent dredging undertaken by the Town of Georgetown. Dredging was done on Clear Creek downstream from the 15th Street Bridge and on South Clear Creek downstream from the Rose Street Bridge.

Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1).

Roughness coefficients (Manning's "n" values) were selected for the HEC-2 program. They were obtained by the CWCB staff field survey. Roughness values for Clear Creek varied from 0.035 to 0.055 for the channel and from 0.030 to 0.090 for the overbank areas. Roughness values for South Clear Creek varied from 0.040 to 0.050 for the channel and from 0.035 to 0.080 for the overbank areas.

The bridge capacities were analyzed by a procedure in which bridges were modeled using the HEC-2 computer program with the computer calculations being checked by hand calculations. Ten percent blockage of bridge openings due to debris was assumed.

A starting water-surface elevation was established from the elevation of Georgetown Lake. This elevation was derived from the overflow rating curve for the spillway at the lake.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation Reference Marks (ERMs) used in this study are shown on the maps; the descriptions of the marks are presented in ERMs (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study

includes a floodplain boundary map designed to assist communities in developing sound floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For each stream studied by detailed methods, the boundaries of the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section.

Between cross sections, the boundaries were interpolated using a Kucera and Associates, Inc., topographic map of Georgetown, at a scale of 1:100 with 2-foot contours; and a McDermid Engineering Associates, Inc., map, scale 1:100 with 1-foot contours, of Georgetown Lake vicinity, with some surveying conducted by the CWCB.

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE). Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

Floodways were not computed for the flooding sources studied for this study.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, a flood insurance zone designation is assigned to a community based on the results of the engineering analyses. This zone is as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations (BFEs) derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and

BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplains, and the locations of selected cross sections used in the hydraulic analysis and floodway computations.

7.0 OTHER STUDIES

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic data, and technical and scientific data prepared by other organizations originally for purposes other than the NFIP. The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the NFIP. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267 for consideration for revision of this study.

In preparation for this Flood Insurance Study, information was taken from the February 1987 Flood Hazard Identification Report, Clear Creek and South Clear Creek, Georgetown, Colorado, by the CWCB (Reference 1).

This Flood Insurance Study is in complete agreement with that of Clear Creek County.

A Flood Hazard Boundary Map (FHBM) has been published for the community (Reference 7). The differences between the FHBM and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Department of Natural Resources, Colorado Water Conservation Board, Flood Hazard Identification Report, Clear Creek and South Clear Creek, Georgetown, Colorado, February, 1987.

2. W. Viessman, J. W. Knapp, G. L. Lewis, and T. E. Harbaugh, Introduction to Hydrology, 2nd ed., Harper and Row, New York, 1977.

3. Federal Insurance Administration, Flood Insurance Study, Town of Georgetown, March, 1978 (voided).

4. Colorado Water Conservation Board, Manual for Estimating Flood Characteristics of Natural-Flow Streams In Colorado, Technical Manual 1, 1976.

5. Kucera and Associates, Inc., Map of Georgetown (two sheets), 1:100 scale, 2-foot contours, December 1976.

6. McDermid Engineering Associates, Inc., Map of Georgetown Lake and vicinity, 1:100 scale, 1-foot contours, October 1984.

7. Federal Insurance Administration, Flood Hazard Boundary Map, Town of Georgetown, Community Panel No. 080035 0001 B, effective January 2, 1980.

8. Federal Insurance Administration, Flood Hazard Boundary Map, Clear Creek County, Colorado, Community Panel No. 080034 0001-0175 and 080034 0075A, effective March 11, 1980.

U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, September 1982.

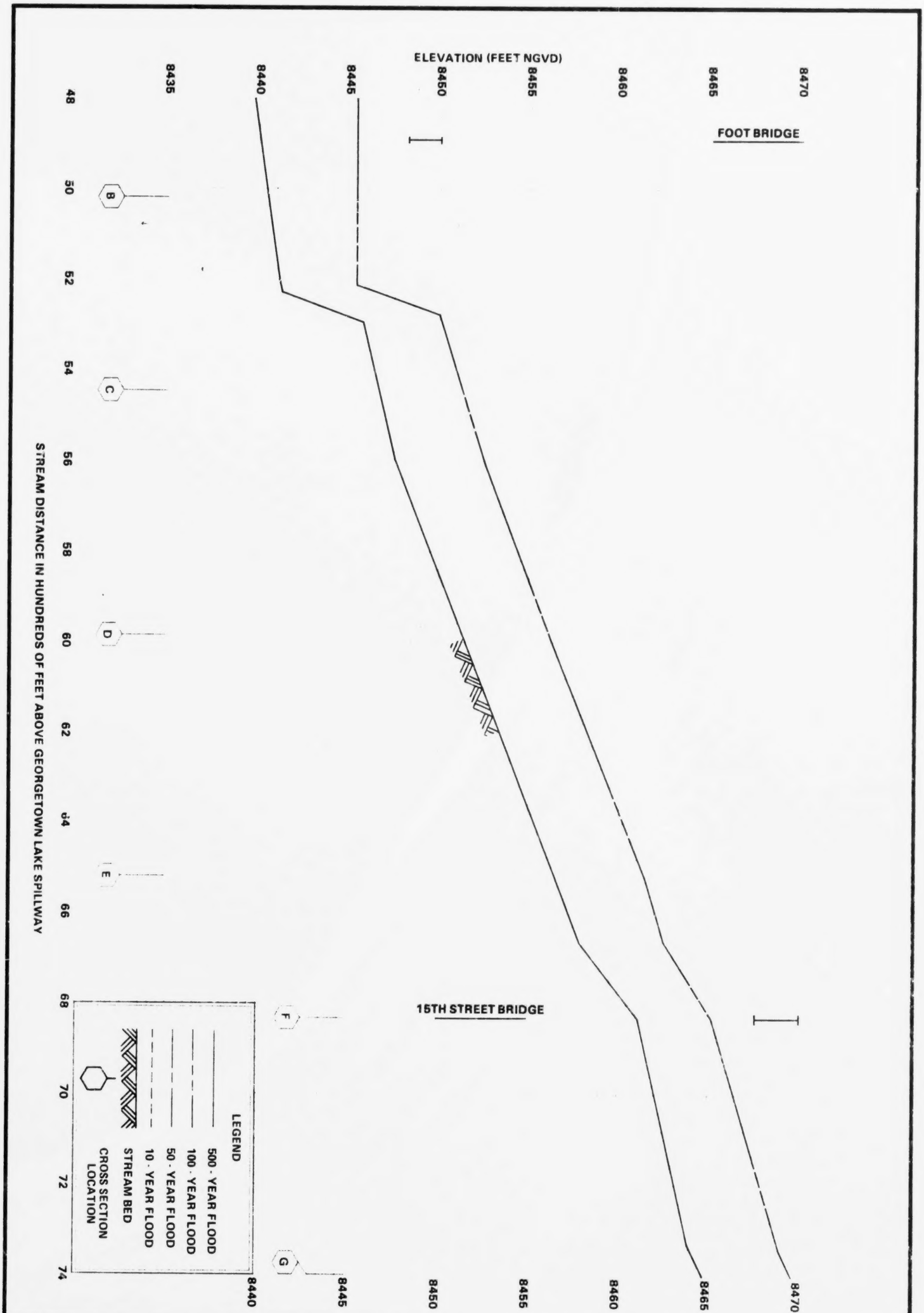
FLOOD PROFILES

CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

01P



02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

FLOOD PROFILES

CLEAR CREEK

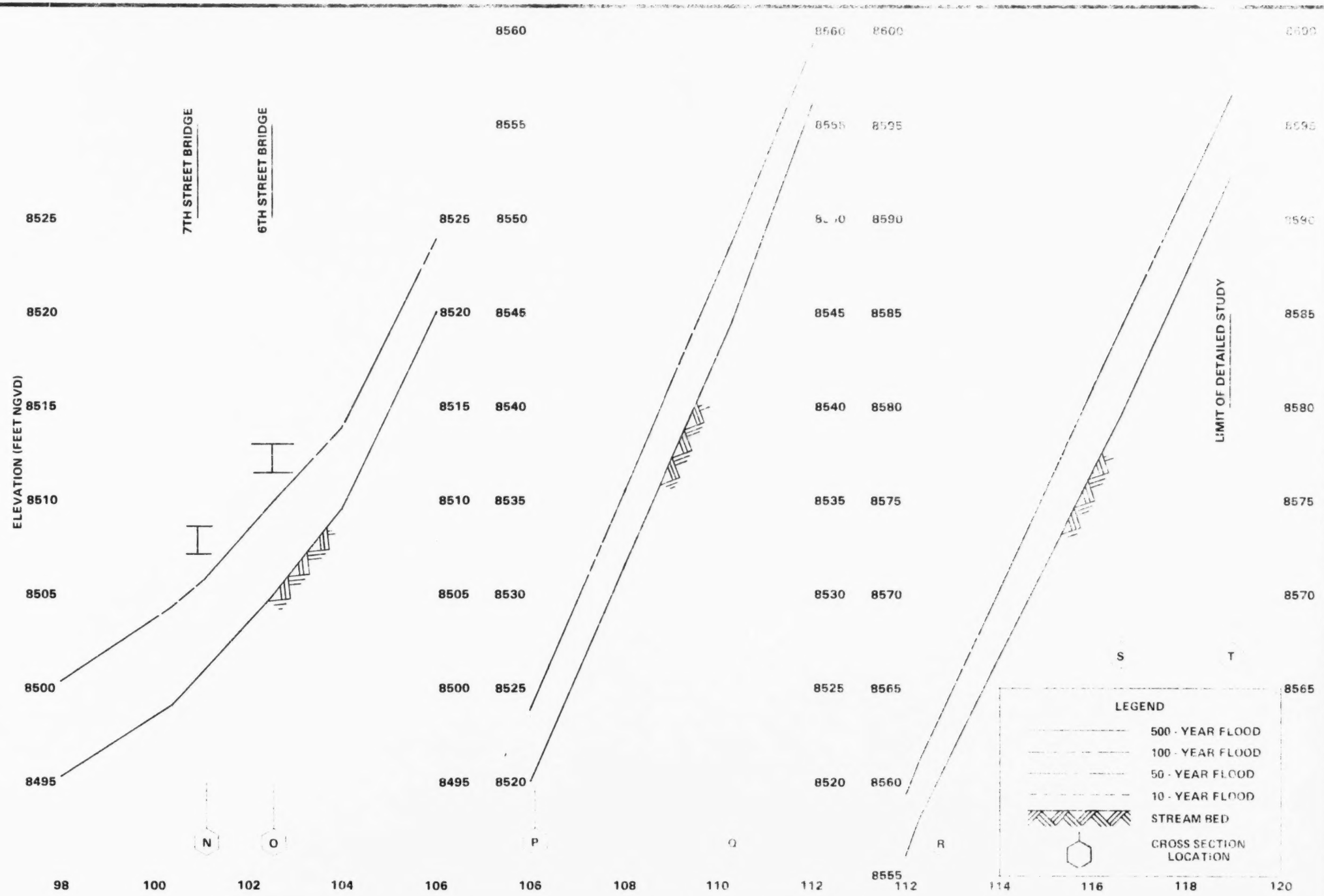
FLOOD PROFILES

CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

03P



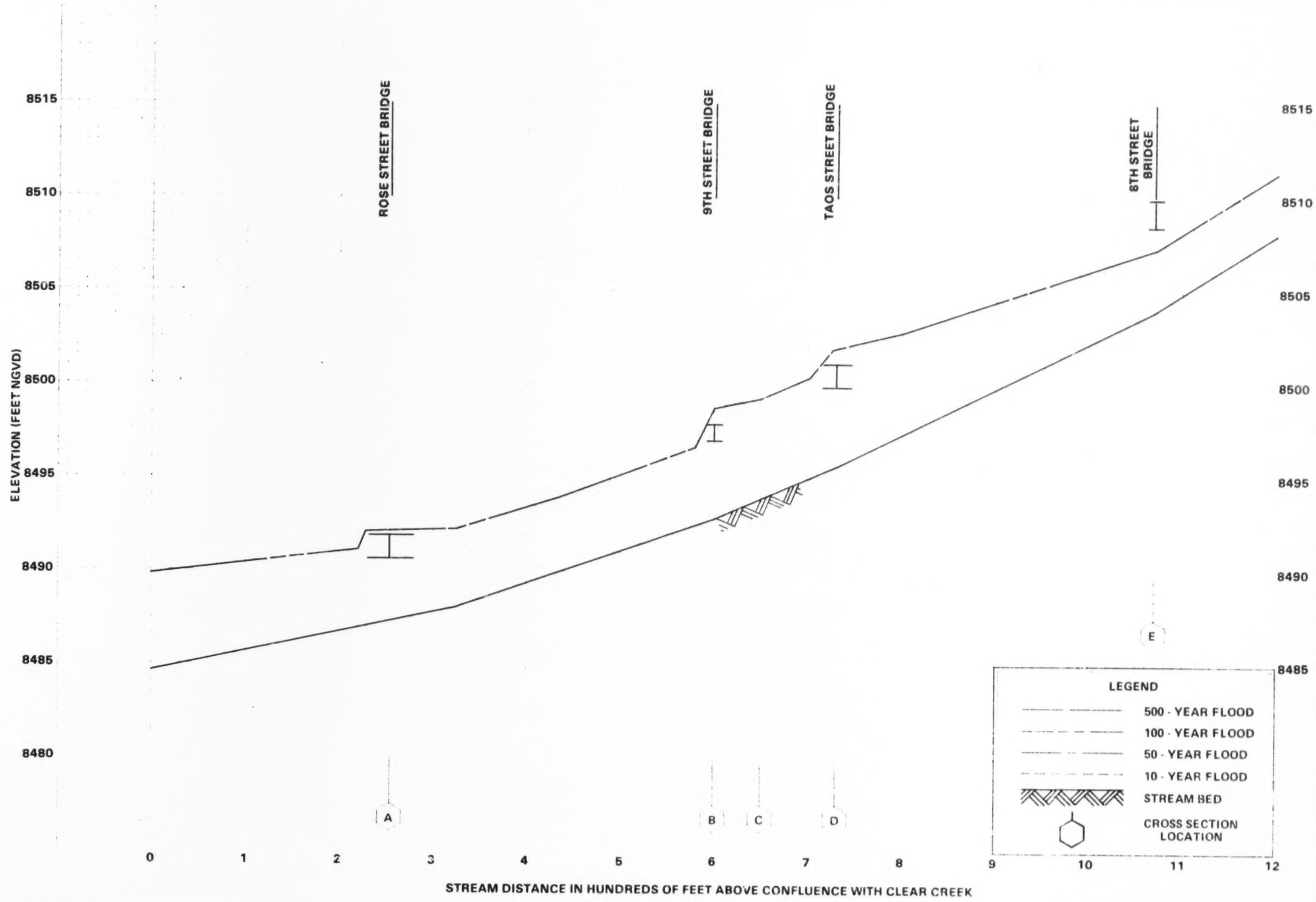
FLOOD PROFILES

CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

04P



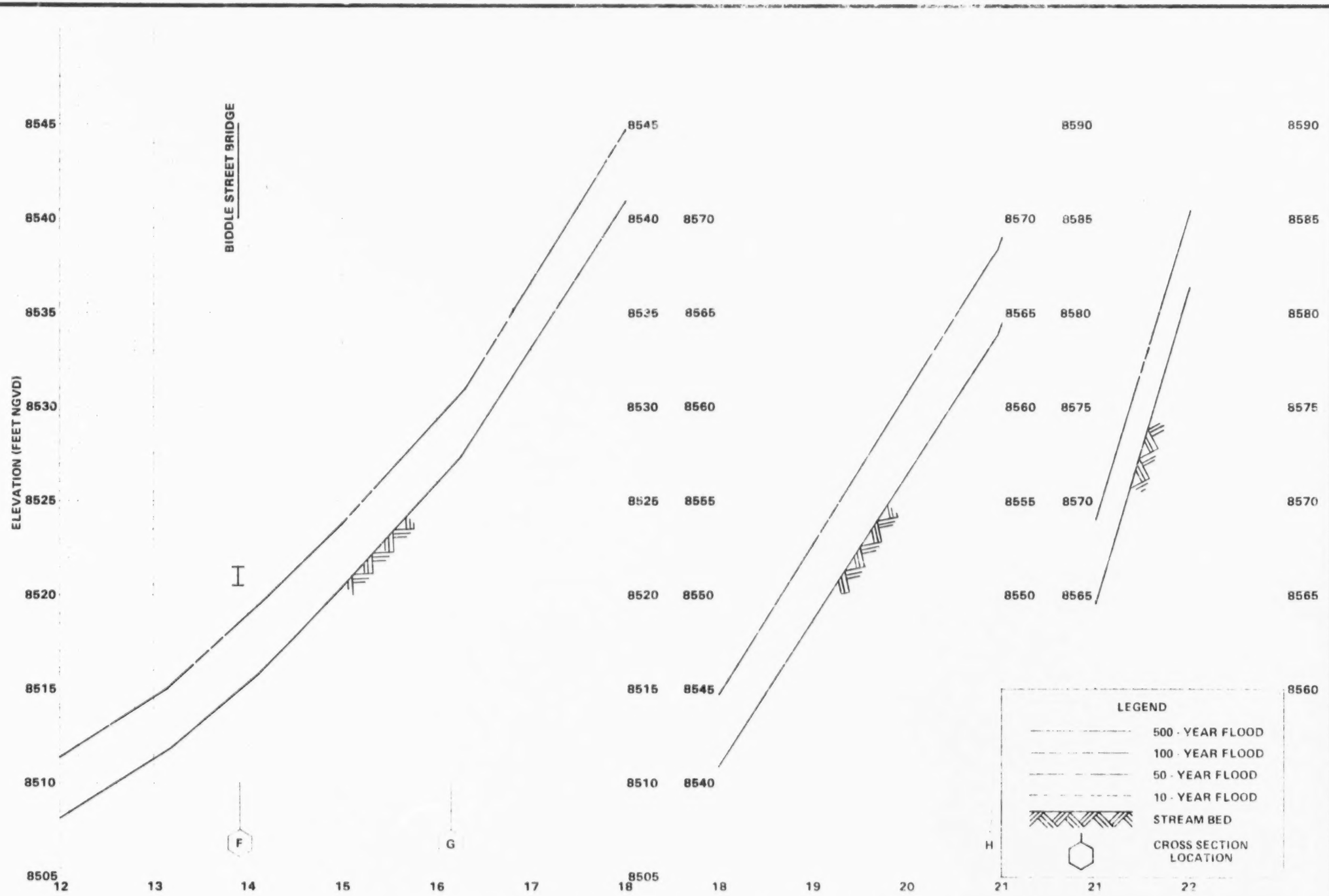
FLOOD PROFILES

SOUTH CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

05P



FLOOD PROFILES

SOUTH CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

06P

FLOOD PROFILES

SOUTH CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GEORGETOWN, CO
(CLEAR CREEK CO.)

07P

EXHIBIT 3 - ELEVATION REFERENCE MARKS
TOWN OF GEORGETOWN, CLEAR CREEK COUNTY, COLORADO

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	8470.600	Chiseled square in southeast corner of walk on north side of 15th Street bridge over Clear Creek. Established by Black and Veatch Consulting Engineers.
RM 2	8505.675	U.S. Geological Survey benchmark, stamped DENVER 8507, set vertically in foundation on east side of old brick school building on Taos between 8th and 9th Streets.